

Accelerated Motion

Acceleration is the change in velocity per unit time.

$$\overline{a} = \frac{\Delta V}{t}$$

$$a = \frac{V_f - V_i}{t}$$

units:  $\frac{[\text{m}]}{[\text{s}]} \rightarrow \frac{\cancel{\text{m}}}{\cancel{\text{s}}} \downarrow$

Ex. A sprinter reaches a speed of  $12 \frac{\text{m}}{\text{s}}$  in  $6.0 \text{ s}$ . What is the acceleration of the sprinter?

$$V_f = 12 \frac{\text{m}}{\text{s}}$$

$$V_i = 0 \frac{\text{m}}{\text{s}}$$

$$t = 6.0 \text{ s}$$

$$a =$$

$$\therefore 2 \frac{\text{m}}{\text{s}^2} \times \frac{1 \text{ km}}{1000 \text{ m}} \times \left( \frac{3600 \text{ s}}{1 \text{ h}} \right)^2 = 25$$

If the sprinter continues to accelerate at this rate, how long does it take to reach  $100 \text{ m}$ ?

$$V_f = 100 \frac{\text{km}}{\text{h}} = 27.8 \frac{\text{m}}{\text{s}}$$

$$V_i = 12 \frac{\text{m}}{\text{s}}$$

$$a = 2 \frac{\text{m}}{\text{s}^2}$$

$$t =$$

$$-62.8 - (12)$$

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It is important to choose a positive direction in 1-D motion. (Everything else is negative.)

Ex. A toy is moving east at  $5.5 \frac{\text{m}}{\text{s}}$ . It accelerates west at  $-2.2 \frac{\text{m}}{\text{s}^2}$  for  $9.0 \text{ s}$ . What is its final velocity? 

$$V_i = 5.5 \frac{\text{m}}{\text{s}}$$

$$a = -2.2 \frac{\text{m}}{\text{s}^2}$$

$$t = 9.0 \text{ s}$$

$$V_f =$$

$$a = \frac{V_f - V_i}{t}$$

$$at = V_f - V_i$$

$$V_i + at = V_f$$

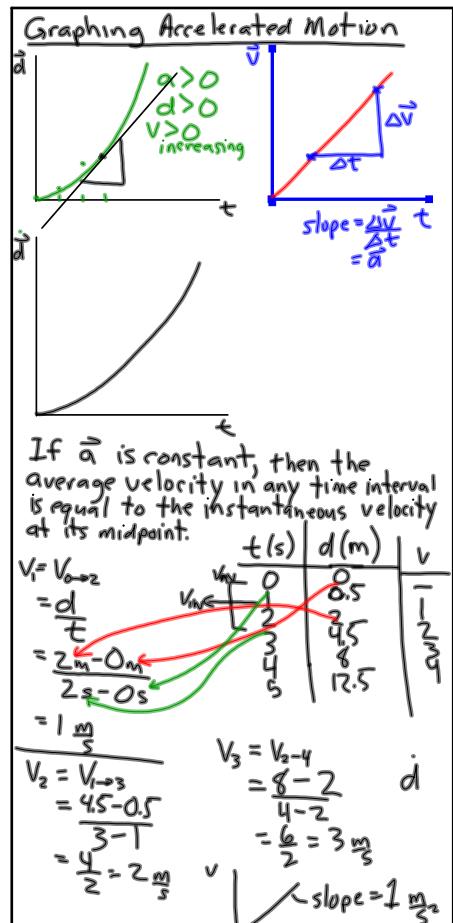
$$V_f = (5.5) + (-2.2)(9.0)$$

$$= 5.5 - 19.8$$

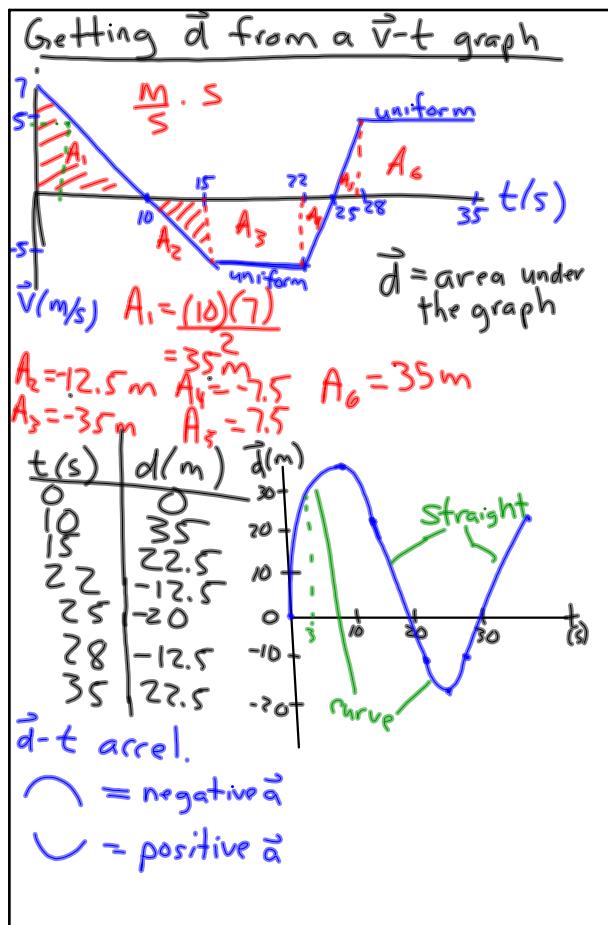
$$= -14.3 \frac{\text{m}}{\text{s}}$$

∴ the toy is now going  $14.3 \frac{\text{m}}{\text{s}} [W]$

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